REMARKS

We are enclosing the priority document, DE 102 58 962.3, filed December 16, 2002.

Claims 5 to 7 have been cancelled leaving claim 1 to 4 and new claim 8 in the application.

Amended claim 1 now specifies a mass flow meter for flowing media which works on the Coriolis principle. The flow meter has at least one straight measuring tube conveying the flowing medium, at least one oscillation generator acting on the measuring tube, at least one measurement sensor detecting the Coriolis forces and/or Coriolis oscillations based on Coriolis forces and outputting a measurement signal and a supporting tube accommodating the measuring tube, the oscillation generator and the at least one measurement value sensor. Claim 1 goes on to recite at least one first stress sensor for detecting the stress state of the measuring tube and that first stress sensor is specified as being a length change sensor. Claim 1 also specifies a correction device for correcting the measurement signal, the at least one measuring tube and the supporting tube being connected to one another at spaced-apart fixing points in a manner excluding relative axial movements and the axial spacing of the fixing points representing the oscillation length of the measuring tube, and the at least one measurement value sensor and the at least one first stress sensor being connected to the correction device, in order to feed the correction device, the measurement signal and the stress signal outputted by the at least one first stress sensor. Finally, claim 1 requires at least one second stress sensor detect-

ing the stress state of the supporting tube, that second stress sensor comprising a length change sensor, the at least one second stress sensor being connected to the correction device in order to feed to the correction device the stress signal outputted by the at least one second stress sensor, so that a measurement signal can be outputted from the correction device that is corrected on the basis of the stress signal outputted by the at least one first stress sensor and the stress signal outputted by the at least one second stress sensor.

The subject matter of amended claim 1 goes back to the subject matter of original claims 1 and 3, i.e. in amended claim 1 it is now stated that the first stress sensor and the second stress sensor each comprise a length-change sensor.

According to new claim 8, the invention concerns a mass flow meter for flowing media which works on the Coriolis principle comprising at least one straight measuring tube conveying the flowing media, at least one oscillation generator acting on the measuring tube, at least one measurement value sensor detecting Coriolis forces and/or Coriolis oscillations based on Coriolis forces and outputting the measurement signal and a supporting tube accommodating the measuring tube, the oscillation generator and the at least one measurement value sensor. Claim 8 also requires at least one first stress sensor for detecting the stress state of the measuring tube, the first stress sensor being a wire strain gauge which is oriented in a longitudinal direction of the measuring tube. Claim 8 also specifies a correction device for correcting the measurement signal, the at least one measuring tube and the supporting tube being connected to one another at spaced-apart fixing points in a manner excluding relative axial movements and the axial spacing of the fixing points representing the oscillation length of the measuring tube, and the at least

one measurement value sensor and the at least one first stress sensor being connected to the correction device, in order to feed to the correction device the measurement signal and the stress signal outputted by the at least one stress sensor. Finally, claim 8 calls for at least one second stress sensor detecting the stress state of a supporting tube, the second stress sensor being a wire strain gauge which is oriented in the longitudinal direction of the supporting tube, the at least one second stress sensor being connected to the correction device in order to feed to the correction device the stress signal outputted by the at least one second stress sensor, so that a measurement signal can be outputted from the correction device that is corrected on the basis of the stress signal outputted by the at least one first stress sensor and the stress signal outputted by the at least one second stress sensor.

The subject matter of claim 8 goes back to the subject matter of original claims 1, 3 and 4. Thus, in new claim 8 it is explicitly stated that the first stress sensor and the second stress sensor each comprise a wire strain gauge, wherein the respective wire strain gauge is oriented in the longitudinal direction of the measuring tube and the supporting tube, respectively.

We request reconsideration of the rejection of claims 1 to 3 as being unpatentable over Cage et al. in view of Poremba and Kalinoski.

Cage et al. describes that using temperature information for the measuring tube and the supporting tube, respectively, compensates for thermally induced axial stress. For that, two temperature sensors are used, one on the measuring tube and one on the supporting tube. In detail, in Cage et al. that is stated (Pat. Col. 11, Lines 45-60):

> "This thermally induced actual stress effect can also be minimized by using a material for both case 4 and conduit 1 with a low coefficient of thermal expansion such as quartz or Invar 32-5 by Carpenter Technology Corporation. Since using low-expansion materials for both case 4 and conduit 1 is not always practical, the method employed in the preferred exemplary embodiment on FIG.1 is to determine the temperature difference between case 4 and conduit 1, then compsensate the final output signal 19 of FIG. 16, functionally related to this temperature difference. Accordingly, mounted in association with case 4 is temperature sensor 41 which is preferably a platinum resistance thermal device (RTD), however many other types of temperature sensors could be used. Temperature sensor 41 is used in conjunction with temperature sensor 29 to determine the temperature difference between case 4 and conduit 1."

Thus, Cage et al. describes using different types of sensors, however, these sensors are always **temperature sensors.**

Thus, the focus of Cage et al. lies in compensating for **thermally** induced axial stress. For this purpose, temperature sensors might be adequate since there may be a known relation between temperature difference and axial stress resulting from the measured temperature difference.

However, there might be other reasons for axial stress like stress resulting from forces from outside the flowmeter. According to the invention, such stress, being different from thermally induced stress, can also be compensated for. This means that according to the invention, any kind of axial stress-thermally induced or not-can be detected in order to receive this information for correction of the measuring signal. According to the invention, this is achieved by the fact that the first stress sensor and the second stress sensor each comprise a length-change sensor, respectively (claim 1), or that the first stress sensor and the second stress sensor comprise wire strain gauges oriented in the longitudinal direction of the measuring tube and the supporting tube, respectively (claim 8). Thus,

according to the invention, a **direct measurement** of the change in length is possible and thus, the stress in the longitudinal direction can be measured.

According to the Examiner, the use of length-change sensors has been rendered obvious by Kalinoski. However, his "strain gauges 110" cannot be compared to the length-change sensors/wire strain gauges which are used for the claimed invention. In Kalinoski, it is explicitly described that part 110 is a **transducer** which is adapted to vibrate a flow tube of a Coriolis flowmeter. Further, the transducer 110 can also serve to sense vibrations of the flow tube. Thus, the transducers 110 known from Kalinoski can only be compared to the oscillation generator acting on the measuring tube and the measurement value sensor detecting Coriolis forces and/or Coriolis oscillations based on Corilolis forces according to the invention. However, the transducers 110 according to Kalinoski **are not used** for detecting stress of the measuring tube or supporting tube, respectively.

With reference to that, in Kalinoski it is stated (Pat. Col. 5, Lines 22-46, emphasis added):

> "Briefly described, the present invention includes a transducer 110 (FIG. 5) adapted to vibrate flow tub 14 of a Coriolis flowmeter 112 (FIG. 7) at a predetermined resonance frequency with or without being mounted to a stationary support. Coriolis flowmeter 112 may then be utilized to determine mass flow rate therethrough in a conventional manner. Transducer 110 includes a solid state strain element such as a piezoelectric element 118 or a magnetostrictive element 218 fastened directly to a wall portion of a Coriolis flow tube 14 as shown for example in FIGS. 5, 14 and 15. The strain elements each have a longitudinal axis which extends parallel to a central axis 19 of the flow tube 14 (FIG. 5). **The elements 118 and 218 are each adapted to expand and contract along their longitudinal axes in response to an electronic or magnetic field. Since this expansion and contraction occurs at a distance from the neutral axis of bending**

> **of the tube, the tube experiences alternating bending movements and the tube is caused to vibrate orthogonal to the axis of the flowtube 14.** Similarly strain elements 118 and 218 are adapted for being alternately expanded and contracted by movement of the flow tube 14 to generate changes in the electric or magnetic fields thereat, **to thereby function as vibration sensors. Transducers 110, 210 and 310 of the present invention thus serve to sense and generate vibration of the flow tube in a direction substantially orthogonal to the amplitude direction of tube vibration.** As used herein, the "amplitude direction" is the direction of tube vibratory movement, namely, the direction normal to axis 19. Advantageously, the present invention provides a relatively high force, low compliance transducer suitable for mounting proximate to, or at, a mechanical ground or node of flow tube 14. The transducer has a relatively low mass for reduced effect on the resonant frequency of the flow tube and enabling use of relatively short electrical leads for improved use on relatively small Coriolis flowmeters."

From this, it is clear that Kalinoski does not say explicitly or give any hints to use transducers 110 which include a solid state strain element **for detecting stress of the measuring tube**. On the contrary, those transducers serve for inducing and sensing vibrations of the measuring tube. This means that the Examiner's opinion that Kalinoski has rendered the invention obvious has to be rejected as an inadmissible ex-post analysis.

In other words, there is nothing in Cage et al., Poremba or Kalinoski that remotely suggests using a length-change sensor, specifically a strain gauge, for detecting stress of a measuring tube. That possibility only becomes apparent after the Examiner has had the benefit of applicant's disclosure. It is well settled in the law that such a hindsight application of the prior art is not permissible.

Accordingly for the foregoing reasons, claims 1 to 4 and 8 should be allowed.

Please charge any additional fee occasioned by this paper to our Deposit Account No. 03-1237.

Respectfully submitted,

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